FIDS File Report 87-2

Forest Insect and Disease Conditions

Kamloops Forest Region
1986

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SUMMARY

This report outlines the status of forest pest conditions in the Kamloops Forest Region in 1986. Emphasis is placed on pests which are capable of sudden damaging outbreaks and some population trends are forecast.

The most important forest pest in the Region continues to be **mountain pine beetle** which killed 4 790 000 mature pine over 46 750 ha in Lillooet, Okanagan, Kamloops and Merritt Timber Supply Areas (TSAs). **Elytroderma needle disease** infections of ponderosa pine declined slightly throughout the host range in the Region. The **pine sawfly** infestation near Vavenby collapsed. **Lophodermella needle casts** moderately defoliated lodgepole pine in Tranquille River Valley, but elsewhere in the Region infection levels were reduced. Nearly 80% of the lodgepole pine were infected by **Atropellis canker** near Salmon Arm and Nicola Lake.

The **western spruce budworm** outbreak more than doubled to 407 980 ha of light to severe defoliation of Douglas-fir in all TSAs. **Douglas-fir tussock moth** populations collapsed at Cherry Creek where populations had persisted in 1985.

Mature Engelmann spruce were killed over 2 100 ha by **spruce beetle** in Merritt and Lillooet TSAs, up from 1 020 ha in 1985. **Two-year-cycle spruce budworm** lightly to moderately defoliated Engelmann spruce and alpine fir in the North Thompson River Valley and Wells Gray Provincial Park, for the first time since 1979.

The **western balsam bark beetle** killed mature alpine fir over 2 290 ha, up markedly from 600 ha last year.

Larch budmoth populations east of Okanagan Lake collapsed after 8 900 ha of light to severe defoliation in 1985. **Larch casebearer** populations remained low.

The **western blackheaded budworm** population in western hemlock and western red cedar in Wells Gray Provincial Park collapsed after causing 3 100 ha of light defoliation in 1985. **Hemlock sawfly** populations also were at a low level in Interior wet belt stands.

There were 390 insect and disease collections sent to PFC by FIDS personnel on field assignments in Kamloops and Summerland from May 20 to September 25 (Map 1).

Damaging defoliating insects were collected in 92% of beating collections, up from 78% in 1985.

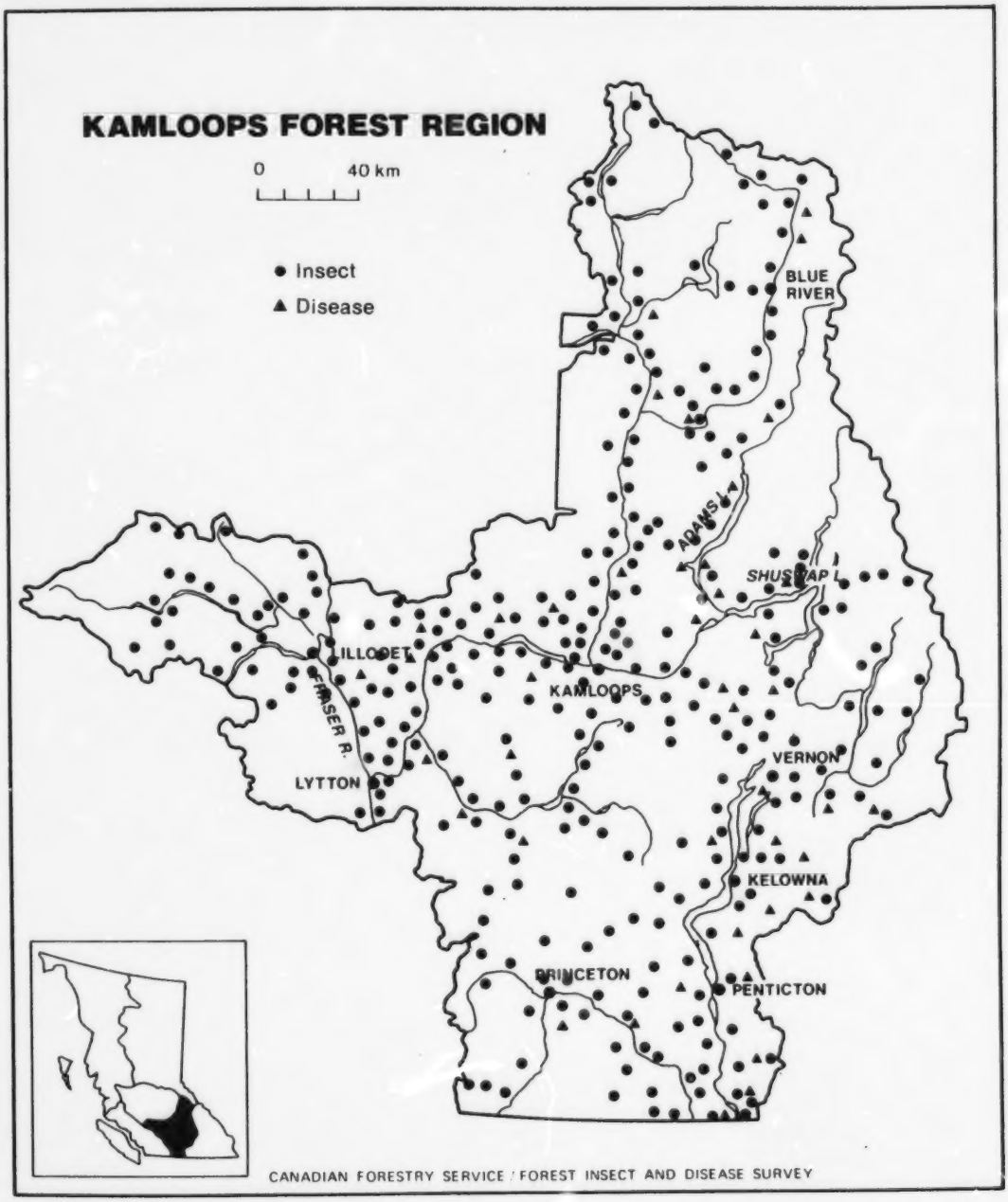
Special surveys were carried out for **larch budmoth, pinewood nematode, European pine shoot moth, and clearwing moths**. Pheromone-baited traps were set out for **western spruce budworm, Douglas-fir tussock moth, gypsy moth, larch casebearer, European pine shoot moth, larch budmoth** and **black army cutworm**.

An intensive annual aerial survey using fixed-wing aircraft logged 60.8 hours (Map 2), mostly to map western spruce budworm. The Canadian Forestry Service provided 15 hours flying time, the B.C. Forest Service, Kamloops Region, supplied the remainder.

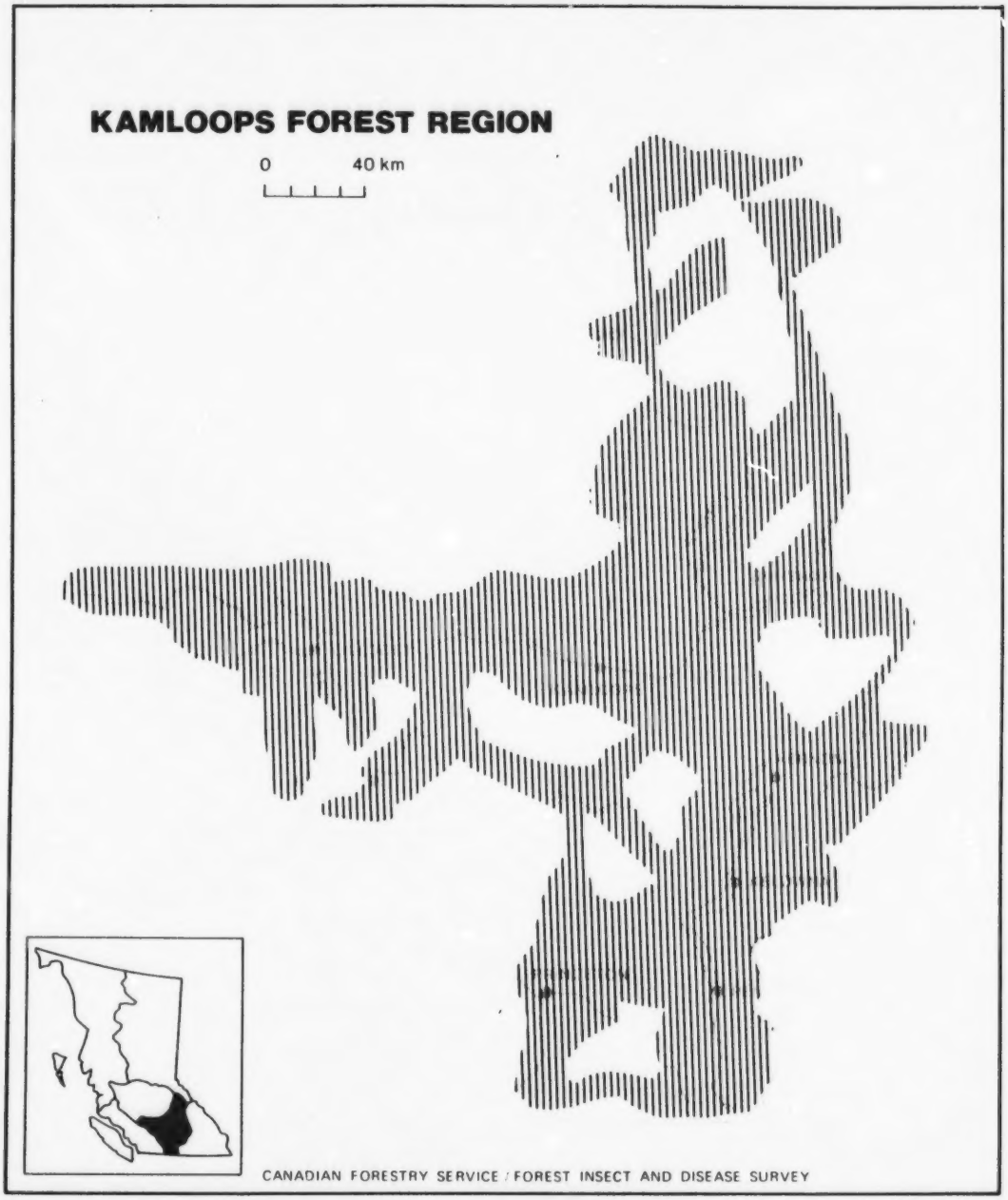
Technical information and services were supplied on approximately 95 occasions - to the general public, government agencies and the forest industry in Kamloops Forest Region. A one-day western spruce budworm egg sampling course was given to the British Columbia Forest Service in Kamloops.

During annual surveys of provincial parks, 21 of 39 parks examined contained serious forest pests. These surveys were done in cooperation with B.C. Ministry of Environment and Parks.

Large scale copies of maps included in this Report are available on request at the Pacific Forestry Centre, Canadian Forestry Service, 506 West Burnside Road, Victoria, B.C. V8Z 1M5.



Map 1. Locations where one or more forest insect and disease samples were collected in 1986.



Map 2. Areas covered by aerial surveys to map bark beetle and defoliator infestations, 1986.

PINE PESTS

Mountain pine beetle, Dendroctonus ponderosae

An estimated 4 790 000 (2 294 400 m^3) lodgepole, white and ponderosa pine were recently killed over 46 750 ha in the Region, up slightly from 4 533 000 trees over 46 760 ha last year (Table 1, Map 3). Most of the tree mortality was in Lillooet (68%) and Okanagan Timber Supply Areas (TSAs).

Stands in which 80% or more of the pine component was killed in or before 1984 were mapped as "grey" (Table 2). These contained 3 488 500 grey pine trees over 38 350 ha, up from 2 496 000 trees over 25 100 ha in 1985. About 90% of the grey areas mapped this year were in older, more inaccessible infestations in the Lillooet TSA.

Table 1. Location, area, number and volume of pine trees recently killed (red) by mountain pine beetle, Kamloops Forest Region, 1986.[1]

TSA	Area (ha)	No. of trees killed	Vol. of trees killed (m^3)
Kamloops	340	20 400	13 000
Lillooet	30 630	3 140 450	1 559 000
Okanagan	11 770	1 197 500	550 000
Merritt	4 010	431 650	172 400
Total	46 750	4 790 000	2 294 400

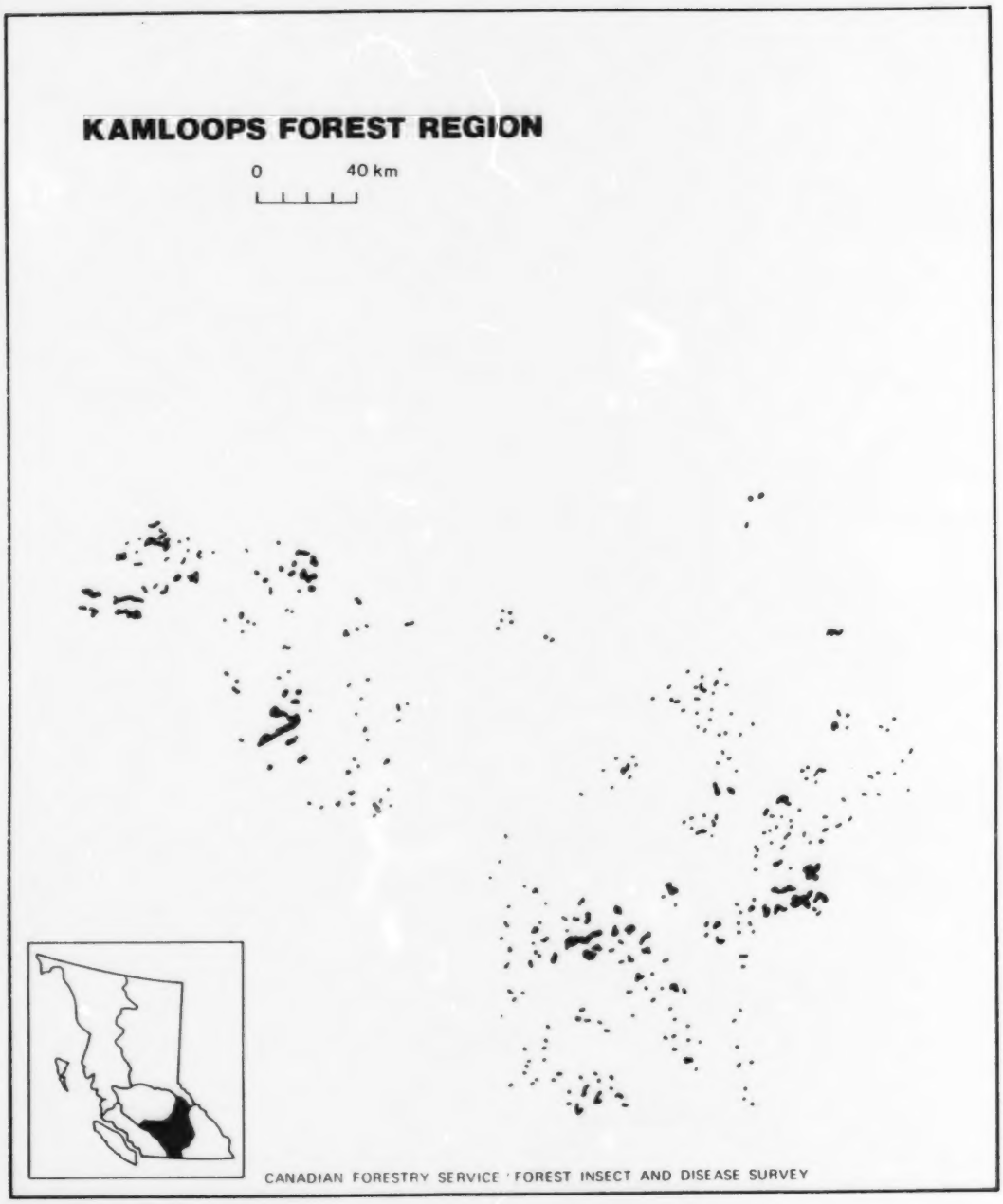
[1]Determined from aerial and ground surveys and digitized at PFC.

Table 2. Location, area, number and volume of pine trees killed before 1985 (grey) by mountain pine beetle, Kamloops Forest Region, 1986.[1]

TSA	Area (ha)	No. of trees killed	Vol. of trees killed (m^3)
Kamloops	0	0	0
Lillooet	34 500	3 450 000	1 725 000
Okanagan	1 920	19 200	76 800
Merritt	1 930	19 300	77 200
Total	38 350	3 488 500	1 879 000

[1]Determined from aerial and ground surveys and digitized at PFC.

There were 30 630 ha of recently killed pine mapped this year in Lillooet TSA, down from 37 000 ha in 1985. Most of this was in the higher-



Map 3. Areas of pine recently killed by mountain pine beetle, determined by aerial and ground surveys, 1986.

elevation stands and included 4 930 ha of recently killed lodgepole, ponderosa and white pine along Downton Lake and Bridge River, down from 7 650 ha last year. North from Downton Lake to Tyaughton Lake, only 1 770 ha of red trees were mapped, nearly 3 000 ha less than 1985. Infested trees were mapped over 730 ha in the Gold Bridge area, in the 10th year of mountain pine beetle infestation there. A 75% reduction in area of recently killed trees to 1 050 ha occurred along lower Marshall and Tyaughton creeks. In the Stein River Valley and upper tributary drainages, 5 540 ha of mainly lodgepole pine were recently killed, similar to 1985. North of Lillooet along the Fraser River at McKay, Leon, Watson Bar, French Bar and South French Bar creeks, lodgepole pine over 10 600 ha were killed, more than double the area infested last year.

The area containing trees killed before 1985 (grey) in the Lillooet TSA increased 50% to 34 500 ha. Most were along Downton Lake to Tyaughton Lake over 11 370 ha, over 4 250 ha in the Gold Bridge area, 7 570 ha along lower Marshall and Tyaughton creeks and over 3 050 ha throughout the Stein River Valley.

In the fifteenth year of continuous infestation at Hayes and Trout creeks in the Okanagan TSA, 3 760 ha of recently killed trees were mapped, up from 3 050 ha in 1985. The increase occurred away from the main valley along Siwash Creek and near Mt. Kathleen. Grey trees were mapped over 1 750 ha. A major infestation nearby in the Merritt TSA at Summers Creek contained 570 ha of dead pine, a slight increase from 470 ha recorded last year. More than 600 ha of recently killed lodgepole pine were mapped in 2- to 20-ha patches from Manning Park to Princeton, up from 100 ha in 1985. In Manning Park near Eastgate, lodgepole pine were killed over 160 ha, mostly at Copper Creek. An estimated 175 ha of recently killed pine were mapped along the Ashnola River and in Cathedral Park, down from 200 ha in 1985. A steady decline of the infestation along the Ashnola River began three years ago.

In the Okanagan TSA, the largest infestations were east of Okanagan Lake from Vernon south to Kelowna. East of Kelowna at Mission-Belgo creeks, there were 2 140 ha of recently killed pine and 870 ha grey, down from 3 200 ha of red in 1985. This infestation will continue to decline due primarily to host depletion over the last 15 years. From Mission and Belgo creeks north to Vernon, dead lodgepole pine were recorded over 990 ha in scattered 2- to 50-ha patches. Near Beaverdell 1 130 ha were mapped along Dale Creek, continuing a gradual increase which began in 1979. North of Beaverdell from Hydraulic Lake west to Lebanon Lake, pine over 3 230 ha were mapped in 100 patches of 2 to 500 ha. In Okanagan Mountain Provincial Park where 180 ha of grey were mapped, 410 ha were recently killed, up from 350 ha last year. This was the eighth consecutive year of mountain pine beetle infestation in the Park.

Prism cruises in 11 infestations in two TSAs in September indicated a decline in current attack at most locations. The average incidence of current attack, 4% (range 0-17%), declined from 12% (range 2-27%), in 1985 and 15% (range 1-50%), in 1984. The decrease was due to the absence of host material in some areas and the high incidences of overwintering brood mortality caused by unseasonably cold weather in November 1985. In the Lillooet TSA, average overwintering mortality of mountain pine beetle was 90% at 5 locations. Subsequent prism cruising in September at the same locations recorded an average of only 2% current attack.

Table 3. Mountain pine beetle cruise data, Kamloops Forest Region, 1986.

TSA and Location	Healthy	Current Attack	Partial Attack	Dead Red	Dead Grey	Dead other causes	Total
Okanagan TSA							
Hydraulic Cr.							
stems/ha	781	272	104	343	30	101	1628
volume/ha (m^3)	77	52	20	80	7	6	242
% of stems	48	17	6	21	2	6	100
% of volume	32	22	8	33	3	2	100
Lower Belgo Cr.							
stems/ha	506	39	11	89	229	0	874
volume/ha (m^3)	79	12	4	42	71	0	208
% of stems	58	5	1	10	26	0	100
% of volume	38	6	2	20	34	0	100
Ideal L. (Belgo Cr.)							
stems/ha	1263	0	38	30	83	0	1414
volume/ha (m^3)	192	0	17	15	36	0	261
% of stems	89	0	3	2	6	0	100
% of volume	74	0	6	6	14	0	100
Daves Cr.							
stems/ha	884	38	58	138	16	115	1249
volume/ha (m^3)	111	14	13	47	2	5	192
% of stems	71	3	5	11	1	9	100
% of volume	58	7	6	25	1	3	100
Bull Cr.							
stems/ha	1265	65	24	69	51	26	1500
volume/ha (m^3)	131	21	5	21	6	1	185
% of stems	84	4	2	5	3	2	100
% of volume	71	11	3	11	4	0	100
Kathleen Main Km 21							
stems/ha	388	53	25	175	28	0	669
volume/ha (m^3)	55	25	4	66	12	0	162
% of stems	58	8	4	26	4	0	100
% of volume	34	15	3	41	7	0	100
Lillooet TSA							
Murphy Cr.							
stems/ha	739	0	15	153	121	8	1036
volume/ha (m^3)	150	0	6	47	46	3	252
% of stems	71	0	1	15	12	1	100
% of volume	60	0	2	19	18	1	100

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TSA and Location	Healthy	Current Attack	Partial Attack	Dead Red	Dead Grey	Dead other causes	Total
Lillooet TSA cont'd							
Diamond S Ranch							
stems/ha	577	2	6	51	17	0	653
volume/ha (m^3)	184	2	38	7	4	0	235
% of stems	87	1	1	8	3	0	100
% of volume	78	1	16	3	2	0	100
McKay Cr.							
stems/ha	614	5	14	167	83	0	883
volume/ha (m^3)	134	2	7	88	46	0	277
% of stems	69	1	2	19	9	0	100
% of volume	48	1	3	31	17	0	100
Leon Cr.							
stems/ha	785	56	0	138	50	0	1029
volume/ha (m3)	103	11	0	49	26	0	189
% of stems	76	5	0	14	5	0	100
% of volume	54	6	0	26	14	0	100
Noaxe Cr.							
stems/ha	715	20	33	132	88	0	988
volume/ha (m^3)	127	4	9	40	42	0	222
% of stems	73	2	3	13	9	0	100
% of volume	57	2	4	18	19	0	100

Based on overwintering mortality studies and cruise results, new small infestations should increase in the Okanagan TSA, particularly in the Ideal Lake and Vernon areas, at Saunier and Maurice creeks and from Hydraulic Lake to Lebanon Lake. Elsewhere in the Region, infestations should decline.

Elytroderma needle disease, *Elytroderma deformans*

Infection by Elytroderma needle disease, resulting in severe discoloration and brooming of ponderosa pine, declined slightly throughout the host range in the Region in the sixth consecutive year of damage. Infection intensity ranged from 10 to 60% of the needles infected on 7 to 100% of the trees in scattered 5- to 30-ha pockets.

The most severely infected trees were at Louis Creek north of Kamloops, where 10 to 50% of the trees were 40% discoloured over 100 ha. Infections were generally less severe in the Okanagan TSA where 5 to 20% of mature and immature ponderosa pine were infected in scattered 1- to 5-ha pockets throughout the host range.

Severe infections will probably continue throughout most of the host range, based on the history of infection of the disease in the Region.

Pine sawfly, Neodiprion sp.

The pine sawfly population collapsed in lodgepole pine stands between Wire Cache and McMurphy south of Avola, after severely defoliating 500 ha in 1985. No defoliation was recorded and an average of only 20 larvae (range 10-40) per standard beating sample were collected. Overwintering cocoons were collected and reared in 1985 but levels of parasitism were insufficient to have caused the population collapse. The only damage to the 20-m high pine was 5-10% of the branches showing dieback symptoms on all of the trees.

Pine sawfly infestations typically last one or two years and then collapse due to parasitism and/or disease. Defoliation is not expected near Wire Cache in 1987.

Lophodermella needle casts, Lophodermella concolor, L. montivaga

Infection of immature and mature lodgepole pine needles by these diseases continued for the fourth consecutive year near Km 80, on the Tranquille River Road. An average of 30% of the needles on all trees were discolored over 50 ha. Trees that had sustained repeated years of severe infection had only the current year's growth left.

Elsewhere in the Region, 10 to 20% of the pine were discolored in small 1- to 2-ha patches throughout the southern Okanagan, from Manning Park to Oliver. In the most severely infected area near Camp Creek, 20 to 80% of the needles were discolored on all 1- to 3-m high lodgepole pine regeneration in a 5-ha plantation.

Repeated annual severe infections often result in reduced height growth and poor form. If the weather in the spring of 1987 is warm and moist, infection levels will probably increase.

Atropellis canker, Atropellis piniphila

Eighty percent of the mature lodgepole pine on two 100 ha patches were infected by Atropellis canker at Charcoal Creek near Salmon Arm and Quilchena Creek near Nicola Lake. Perennial infections have resulted in from one to four, 1-2 m long cankers on the stems. There has been a reduction in annual increment and wood quality but, as yet, no tree mortality has resulted from infections.

Pinewood nematode, Bursaphelenchus xylophilus

No pinewood nematodes were found during the fourth consecutive year of surveys. Woody samples from dead or dying pines, Douglas-fir, western larch and Engelmann spruce were collected at 32 locations. Adult woodborers, a suspected vector of nematodes, were collected at three locations.

Elsewhere in the province, preliminary examinations identified pinewood nematode in samples from the Nelson and Prince Rupert regions. These collections are of economic importance since many countries that import Canadian lumber have placed quarantine restrictions on products suspected of containing the nematode. Surveys will continue next year in the Kamloops Forest Region.

Pine needle sheathminer, *Zelleria haimbachi*

Severe defoliation of the current growth of lodgepole pine by this insect occurred in the Adams Lake-Salmon Arm area.

Multi-age pine lost 80 to 100% of the current growth between Km 5 and Km 10 along Scotch Creek Road. From Km 40 to Km 62 along Adams Lake Road north of Skwaam Bay, the current growth on scattered individuals was 50-100% defoliated. All pines lost from 10-100% of the new foliage in scattered 1- to 5-ha pockets from Birch Island to McMurphy along the Yellowhead Highway. The current growth on 2- to 4-m high lodgepole pine was 50-100% discolored for the second consecutive year over 410 ha at Fly Hills west of Salmon Arm. Near Wallensteen Creek, similar sized pine over 100 ha lost 60-100% of the current growth.

Pine needle sheathminers overwinter as early instar larvae. In early spring they migrate to the needle bases and begin feeding in the needle sheath. Based on patterns of recent infestations, similar damage is expected next year in most infested areas.

European pine shoot moth, *Rhyacionia buoliana*

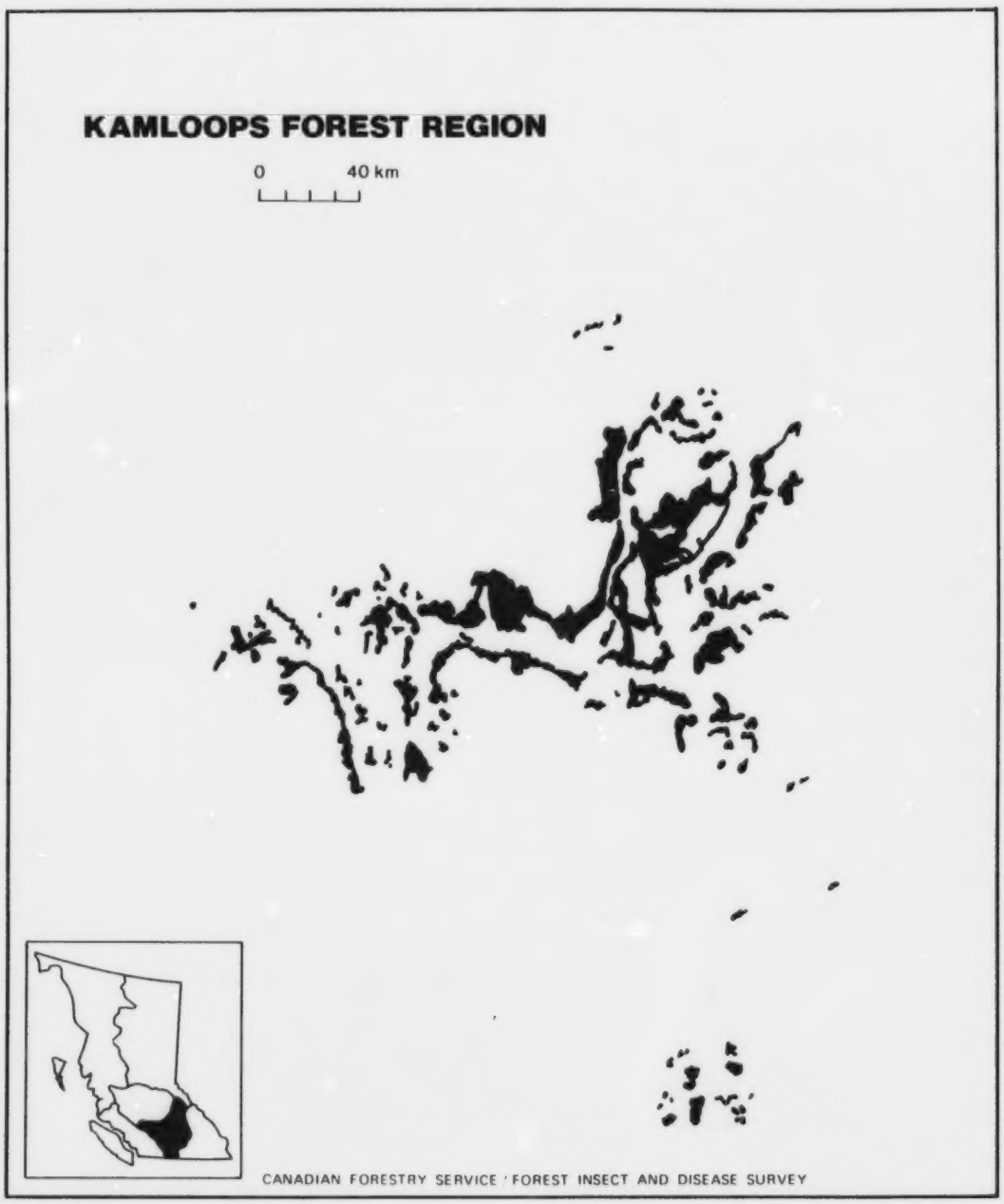
The adult trapping program to monitor the spread of this insect continued at nine locations in the south Okanagan. No moths were caught in the pheromone-baited sticky traps this year, compared with an average of seven (range 0-30) last year. Five traps were placed at each site near uninfested susceptible ornamental pine at each of nine locations between Vernon and Hedley.

Plant quarantines restricted the movement of all pine in the quarantine area to minimize the possibility of spread to native pines until 1981 when it was repeated. However, no such spread has occurred since surveys were initiated in the Region in 1975.

DOUGLAS-FIR PESTS

Western spruce budworm, *Choristoneura occidentalis*

The western spruce budworm outbreak in multi-age stands of Douglas-fir more than doubled in area to 407 980 ha from 180 400 ha in 1985 (Map 4). Defoliation was mainly light over 327 880 ha, with 72 950 ha moderate and 7 150 ha severe, and extended from west of Lillooet to the southern Okanagan and north to Vavenby. Most of the damage occurred in the Kamloops TSA, and to a lesser extent, in the Okanagan, Lillooet and Merritt TSAs (Table 4). Most of the increase was in the light and moderate categories which resulted from a spread to new areas and intensification of defoliation in previously defoliated areas.



Map 4. Areas of Douglas-fir defoliated by western spruce budworm, determined by aerial surveys, 1986.

Table 4. Location and area of Douglas-fir defoliated by western spruce budworm, as determined from aerial and ground surveys, Kamloops Forest Region, 1986.

TSA and Location	Area of defoliation (ha)			
	Light	Moderate	Severe	Total
KAMLOOPS TSA				
Cache Cr.	5 670	580	1 000	7 250
Separating L.-Durand Cr.	4 860	6 500	960	12 320
Deadman R.	6 380			6 380
Barnes L.-Highland Valley	3 520	2 350	650	6 520
Pass Valley	6 470	8 900	600	15 970
Scottie Cr.	3 100	520		3 620
Veasey L.-Hat Cr.	8 370	4 920	370	13 660
Sabiston-Carabine-Criss creeks	17 500	2 200	1 200	20 900
Tranquille R.	8 000			8 000
Durand Cr.-Lac Le Jeune Rd.	10 840	350		11 190
Campbell Cr.	3 600			3 600
Ducks Meadow-Monte L.	4 900			4 900
Little Shuswap L.-Pemberton Hill	6 600	880		7 480
Lac du Bois-Jamieson Cr.	12 400	1 370		13 770
Paul L.	9 500	1 400		10 900
Heffley L.-Heffley Cr.	8 400	1 350	210	9 960
Louis Cr.	4 750	6 780	450	11 980
Barriere	11 630	2 070	1 200	14 900
Orchard L.	4 640	3 500		8 140
Barriere R.	6 000	1 100		7 100
Darfield-Barriere	7 570	900		8 470
Little Fort	10 350	1 670		12 020
Clearwater-Lemieux L.	8 500	2 800		11 300
Mahood L.	1 000	170		1 170
E. Barriere L.	17 000	3 300	230	20 530
Adams L.-Adams R.	35 160			35 160
Dixon Ridge	12 500			12 500
Simmax Cr.-Skwaam Bay	8 100	11 300	230	19 630
Vavenby	8 000			8 000
Subtotal	255 310	64 910	7 170	327 320

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TSA and Location	Area of defoliation (ha)			
	Light	Moderate	Severe	Total
OKANAGAN TSA				
S. of Chase	9 000			9 000
Adams L.-Scotch Cr.	4 060	690		4 750
Skimikin-White L.	3 760	120		3 880
Falkland	3 200			3 200
Glenemma-Irish Cr.	2 520			2 520
Equesis Cr.	670			670
Vernon Hill	180			180
Vaseux Cr.-Anarchist Mtn.	3 630			3 630
Blue L.	1 020			1 020
Mt. Kobau	1 050			1 050
Shoudy Cr.	930			930
Blind Cr.	2 010			2 010
Subtotal	32 030	810		32 840
MERRITT TSA				
Pimainus Ridge	1 650			1 650
Soap L.-Agate Cr.	7 850	2 010	50	9 910
Subtotal	9 500	2 010	50	11 560
LILLOOET TSA				
Botanie Cr.	650			650
Twaal Cr.	3 000			3 000
Lytton-Intlpam Cr.	3 180	2 000		5 180
Izman Cr.	1 200			1 200
Lillooet-Fountain	7 070			7 070
Pavilion	2 170	250		2 420
Carpenter L.	460	110		570
Cayoosh Cr.	2 200			2 200
Anderson-Seton L.	4 550	1 100		5 650
D'Arcy	1 400	330		1 730
Yalakom R.	2 330	180		2 510
Mission Pass	2 830	1 250		4 080
Subtotal	31 040	5 220		36 260

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TSA and Location	Area of defoliation (ha)			
	Light	Moderate	Severe	Total
SUMMARY				
KAMLOOPS TSA	255 310	64 910	7 100	327 320
OKANAGAN TSA	32 030	810		32 840
MERRITT TSA	9 500	2 010	50	11 560
LILLOOET TSA	31 040	5 220		36 260
GRAND TOTAL	327 880	72 950	7 150	407 980

[1]Light : discolored foliage barely visible from the air, some branch tip and upper crown defoliation.

Moderate: pronounced discoloration, noticeably thin foliage, top third of many trees severely defoliated, some completely stripped.

Severe : bare branch tips and completely defoliated tops, most trees sustained more than 50% total defoliation.

In the Kamloops TSA, light to severe defoliation occurred over 24 530 ha from Cache Creek to Scottie Creek, west to Veasey Lake and south to Hat Creek, a slight increase from 21 680 ha in 1985; some of the most severe defoliation occurred on Campbell Hill west of Cache Creek. Douglas-fir stands were lightly to severely defoliated over 12 320 ha, more than double the area defoliated in 1985, from Separating Lake east of Ashcroft to Durand Creek south of Savona. Ten consecutive years of defoliation in this area have resulted in dead trees, tops and branches on both advanced regeneration and mature trees. There was an average 5.6% (range 0-15%) mortality of mature Douglas-fir in three annually assessed defoliator appraisal plots established in 1983. These plots are located at Separating Lake near Ashcroft, Indian Gardens near Savona and Orchard Lake near Heffley Creek.

The area of defoliated Douglas-fir nearly doubled to 6 520 ha from Barnes Lake south to the Highland Valley.

More than 50% of the 15 970 ha defoliated northeast of Cache Creek in Pass Valley were moderate, an increase in intensity from 1985 when 85% of the slightly smaller area was lightly defoliated. Light defoliation along Deadman River north of Savona doubled to 6 380 ha.

A 15% decrease from 1985 levels to 28 900 ha of light to severe defoliation occurred east from Deadman River along Kamloops Lake to the North Thompson Valley including Sabiston and Carabine creeks and the Tranquille River. Five consecutive years of severe defoliation at Carabine and Sabiston creeks has resulted in small patches of dead advanced regeneration and dead tops on mature trees.

A slight increase of mainly light defoliation totalling 11 190 ha occurred from Durand Creek to the Lac Le Jeune Rd. A tenfold increase to

3 600 ha of light defoliation occurred in the second year of infestation in the Campbell Creek area, southeast of Kamloops. North of Kamloops the outbreak spread from Little Fort to Vavenby and east along Adams Lake and the Adams River to Wallace Creek, with a slight decrease in intensity of defoliation from Lac du Bois north to Jamieson Creek. Although the infested area increased to 10 900 ha near Paul Lake, defoliation intensity decreased to mainly light. An increase to 9 960 ha of mainly light defoliation from 7 140 ha last year was mapped in the Heffley Lake and Heffley Creek areas. Along Louis Creek, the area of defoliation remained nearly the same as 1985; however, the intensity increased to mostly moderate.

Increases in defoliation intensity occurred in previously defoliated areas, and many areas were infested for the first time near Barriere and north to Vavenby. Approximately 38 610 ha of Douglas-fir forest were lightly to severely defoliated, two and one half times more than 1985. Defoliation intensity increased to 41% moderate and severe defoliation from 23% last year.

Light defoliation over 8 010 ha north of Little Fort to Clearwater and along the North Thompson River to Vavenby marked the first time in recorded pest history that infestations had occurred in the Clearwater and Vavenby areas. Light and moderate defoliation occurred over 1 170 ha on the north side of Mahood Lake, west of Clearwater. Infestations expanded fourfold to 20 530 ha of light to severe defoliation near East Barriere Lake. Large expansions of light to severe defoliation to 19 630 ha occurred east of Barriere along Simmax Creek to Skwaam Bay including Dixon Ridge and north along Adams Lake and River to Wallace Creek. This area was last defoliated between 1974-76, when, at its peak, 17 000 ha were infested.

East of Kamloops, there was a sevenfold increase to 7 480 ha of light and moderate defoliation from Little Shuswap Lake west to Pemberton Hill near Monte Creek, and a fivefold increase to 4 900 ha of light defoliation from Ducks Meadow to Monte Lake.

In the Okanagan TSA, new areas of mainly light defoliation occurred in the Chase-White L. area over 17 630 ha, near Falkland over 3 200 ha and in pockets totalling 3 370 ha from Vernon to Glenemma. Previous infestations expanded to 4 680 ha on Mt. Kobau and Anarchist Mtn. and new infestations totalled 3 920 ha near Keremeos.

Light to severe defoliation occurred in the Merritt TSA on Pimainus Ridge over 1 650 ha compared with only 100 ha of light in 1985. From Soap Lake to Agate Creek over 9 910 ha were lightly to severely defoliated.

In the Lillooet TSA, defoliation expanded to 36 260 ha of light and moderate from 16 190 ha last year, concentrated again along the Fraser River and west of Lillooet.

New areas of light defoliation developed west of the Fraser River from Lytton to Intlpam Creek, and over 2 200 ha at Cayoosh Creek west of Lillooet. From Botanie Creek to Pavilion Lake including Fountain Valley, Twaal Creek and near Lillooet, the area defoliated more than doubled to 14 340 ha of mostly light. Infestations along Anderson, Seton and Carpenter lakes, Mission Pass and the Yalakom River expanded to 16 000 ha of light and moderate defoliation from 6 700 ha of mainly light in 1985.

Infested buds were examined during late May at 25 locations throughout the 1985 outbreak area to assess the status of overwintering early instar larvae. One hundred buds at each location were examined and the number of infested buds calculated as a percentage to predict the defoliation intensity for the current year (Table 5). Results indicated that predictions were correct at 16 locations (64%); at eight locations (32%) defoliation was less severe than predicted and at one location (4%), it was more severe.

Table 5. Location, percent buds infested by western spruce budworm, predicted defoliation and actual defoliation, Kamloops Forest Region, 1986.

TSA and Location	Percent of buds infested	Defoliation	
		Predicted[1]	Actual
KAMLOOPS TSA			
E. Bonaparte I.R.	34	S	M
McLean L. Rd.	10	L	L
Lower Sabiston Cr.	57	S	S
Upper Sabiston Cr.	15	L	L
Fountain Valley	5	L	L
Scottie Cr.	20	M	L
Pavilion	5	L	L
Hat Cr.	2	L	L
Tranquille L. Rd.	38	S	L
Oregon Jack Cr.	15	L	L
Red L.	20	M	M
Carabine Cr.	36	S	S
Tranquille R. (43 Km)	40	S	M
Tranquille R. (49 Km)	30	M	L
Clearwater	65	S	M
Barriere	34	S	S
Louis Cr.	48	S	S
Faydear Cr. (lower)	25	M	M
Little Shuswap L.	9	L	M
Yard Cr. (Sicamous)	2	L	L
Paul L.	70	S	S
Mt. Harper	50	S	S
Squilax	43	S	L
Pinantan L. Rd.	84	S	L
White L.	11	L	L

[1] 0% buds infested - no defoliation
1-15% " " - light "
16-30% " " - moderate "
31+% " " - severe "

As in 1985, the moth flight occurred during the first two weeks in July, however, fewer adults were visible. Male adult populations were monitored again after a one-year respite, using ten pheromone-baited sticky traps at each of three locations not previously sampled. At McMurphy an average of 47 moths were caught per trap, at Sicamous 55, and on the Dardenelles Lake Rd., 5. However, the number of moths per trap cannot yet be

correlated with population levels, except to show that western spruce budworm is present at the locations trapped.

Budworm egg masses on branch samples collected at 39 locations throughout the outbreak averaged 385 (range 65-1330) per 10 m^2 of foliage, up from 319 (range 72-977) last year (Table 6). Two 45-cm branch tips were cut from each of 10 trees at each location and the number of egg masses on each branch was counted and extrapolated to the number per 10 m^2 of foliage. This number was then compared to established criteria (Table 6 footnote) to predict the severity of defoliation for next year. There was an increase in the number of egg masses at 74% of locations resampled in 1986, indicating severe defoliation in 1987 at 33 locations, moderate at five and light at one. Predictions of 1986 defoliation based on 1985 egg mass surveys were correct at 50% of the sites and overestimated at the remainder. The relative inaccuracy of the prediction results from the setting of the thresholds (footnote 2, table 6) and the possibility of outside influence on the budworm population from time of egg hatch to the end of larval feeding period.

Table 6. Location and average number of western spruce budworm egg masses per 10 m^2 of foliage, predicted defoliation for 1987, and comparisons with 1985, Kamloops Forest Region, 1986.

TSA/Location	Average no. of egg masses/10 m^2 foliage		Predicted 1987 defoliation[2]
	1986	1985[1]	
KAMLOOPS TSA			
Scottie Cr.	351	890	Severe
E. Bonapart I.R.	776	536	Severe
Cache Cr.	500	-	Severe
Skeikut Cr.	412	-	Severe
Pimainus Ridge	276	96	Severe
Highland Valley	260	-	Severe
Separating L.	1 330	359	Severe
Oregon Jack Cr.	112	262	Moderate
Carabine Cr.	604	288	Severe
Sabiston Cr.	766	970	Severe
Indian Gardens	173	890	Severe
Tranquille R.	345	-	Severe
Paul L. Park	425	186	Severe
Heffley L.	492	149	Severe
Louis Cr.	450	-	Severe
Orchard L.	135	263	Moderate
E. Barriere L.	166	-	Severe
W. of Barriere	418	120	Severe
Lemieux L.	274	78	Severe
Burton Cr.	597	-	Severe
Birch Island	518	-	Severe
Ducks Meadow	373	-	Severe
Little Shuswap L.	441	-	Severe
Adams R.	255	-	Severe
Skwaam Bay	438	-	Severe ...

TSA/Location	Average no. of egg masses/10 m^2 foliage 1986	1985[1]	Predicted 1987 defoliation[2]
OKANAGAN TSA			
Falkland	256	-	Severe
Skimikin	450	-	Severe
White L.	509	-	Severe
Round L.	65	-	Moderate
Blind Cr.	238	-	Severe
Blue L.	333	-	Severe
Mt. Kobau	254	155	Severe
Anarchist Mtn.	300	182	Severe
LILLOOET TSA			
Marshall Cr.	83	72	Moderate
Mission Pass	880	392	Severe
Cayoosh Cr.	258	-	Severe
Watson Bar Cr.	149	127	Moderate
Fountain Valley	322	186	Severe
Botanie Cr.	29	0	Light

[1] 20 locations sampled in 1986 were not sampled in 1985.

[2] 1-50 egg masses/10 m^2 - light defoliation
51-150 " - moderate "
151+ " - severe "

Additional egg mass collections were made by B.C. Forest Service pest survey personnel at 81 locations in Kamloops and Okanagan TSAs (Table 7).

Table 7. Average number of western spruce budworm egg masses collected by BCFS with predicted defoliation for 1987, Kamloops Forest Region, 1986.

BCFS District	No. of samples	Range and avg. no. of egg masses/10 m^2	Predicted defoliation and no. of locations	
Clearwater	11	0-392 avg. 121	light moderate severe	5 2 4
Kamloops	53	0-1179 avg. 236	light moderate severe	13 14 26
Salmon Arm	2	104-138 avg. 121	moderate	2

...

BCFS District	No. of samples	Range and avg. no. of egg masses/10 m^2	Predicted defoliation and no. of locations	
Vernon	10	30-630 avg. 226	light moderate severe	1 3 6
Penticton	5	0-465 avg. 193	light severe	2 3

The number of egg masses/10 m^2 of foliage collected by BCFS averaged 199 (range 0-1179), which indicates severe defoliation overall. Defoliation is predicted to be severe at 39 locations, moderate at 21 and light at the remaining 21. The BCFS results indicated generally less severe defoliation than that indicated by CFS-FIDS samples.

Collections of 200-400 early and/or late instar budworm larvae at each of 23 locations reared to assess the incidence of parasitism indicate a 5% decline to 9% (range 0-27), too low a level to effectively reduce budworm populations (Table 8).

Table 8. Location and average percent parasitism in early and late instar[1] western spruce budworm larvae, Kamloops Forest Region, 1986.

Location	Instar	Avg. percent parasitism[2]		
		Hymenoptera	Diptera	Total
Indian Gardens	Early	0	0	0
	Late	3	3	6
Scottie Cr.	Early	2	0	2
	Late	13	1	14
Sabiston Cr.	Early	4	1	5
	Late	6	1	7
Durand Cr.	Early	4	0	4
	Late	0	0	0
Lac du Bois	Early	22	4	26
	Late	11	1	12
Paul L.	Early	8	0	8
	Late	10	1	11
Louis Cr.	Early	15	3	18
	Late	16	1	17
Orchard L.	Early	1	4	5
	Late	19	8	27

...

Location	Instar	Avg. percent parasitism		
		Hymenoptera[2]	Diptera	Total
Knouff L. Rd.	Early	1	<1	1
	Late	18	4	22
Little Shuswap L.	Early	13	5	18
	Late	6	7	13
Adams R.	Early	6	2	8
	Late	1	7	8
Beaton L.	Early	2	0	2
E. Bonaparte I.R.	Early	7	1	8
Oregon Jack Cr.	Early	3	0	3
Barnard Cr.	Late	1	0	1
Venables Valley	Early	16	0	16
Murray Cr.	Early	25	0	25
Harper Mtn.	Early	4	0	4
Campbell Range	Early	9	<1	9
Tranquille R.	Early	5	0	5
Mission Pass	Early	5	0	5
Anarchist Mtn.	Early	4	0	4
Mt. Kobau	Early	2	0	2

[1]Early collections (June 4-16) were mostly second instar. Late instar collections (June 18-25) were fifth instar.
[2]These parasites were 90% Glypta sp. and 10% Apanteles sp.

Parasitism at many of the same locations has varied annually from 18% in 1983, 20% in 1984, 14% in 1985 to 9% this year. Thus far, the average percent parasitism hasn't been reflected in changes in the overall population, although it may be more accurate in predicting localized changes.

Adverse weather, disease and parasitism can reduce populations. Since none of these appear to have been significant this year and egg mass surveys predict continued defoliation, the budworm outbreak is expected to spread and intensify in 1987. Historical infestation patterns (Fig. 1) and egg sample data also suggest that the infestation will expand in several areas including west along Carpenter Lake and feeder drainages, along the Yalakom and Fraser rivers, into the Thompson River drainage from Ashcroft to Lytton, from Shuswap Lake east to Revelstoke and into drainages along Okanagan Lake.

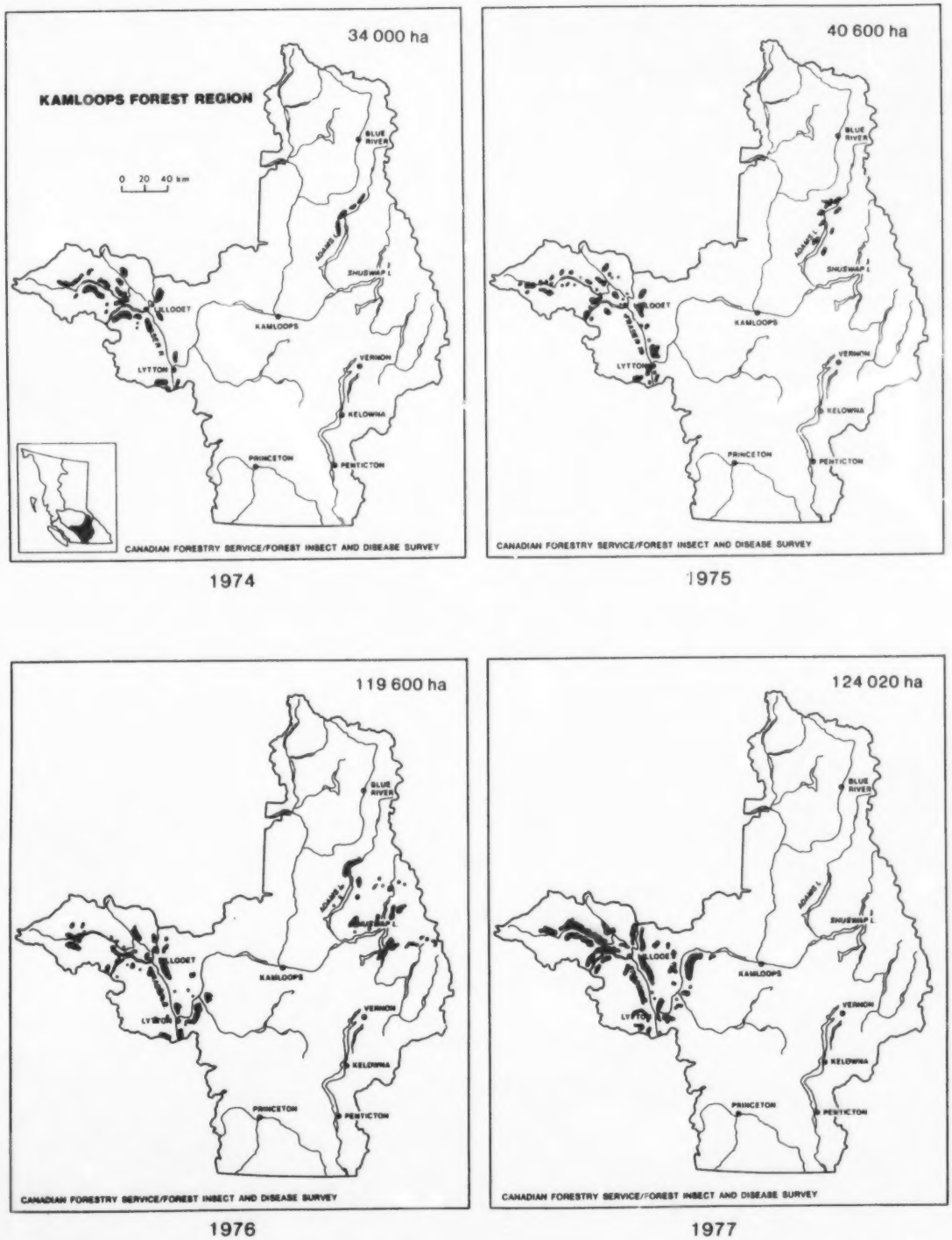
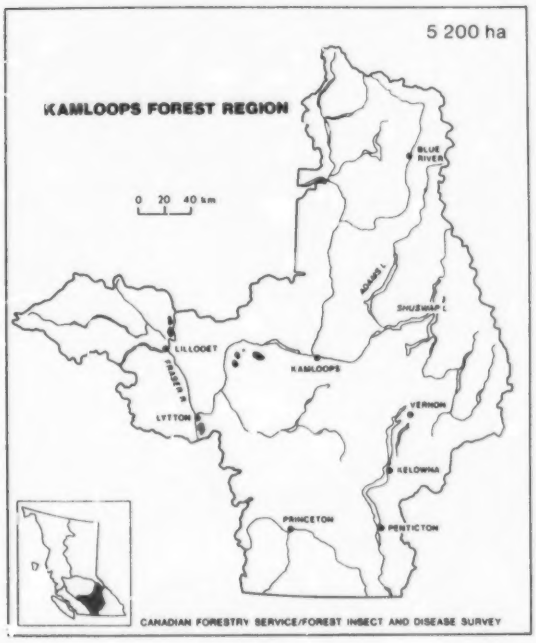


Fig. 1 Areas of western spruce budworm defoliation, Kamloops Forest Region, 1974-1985.

Figure 1 (second page)



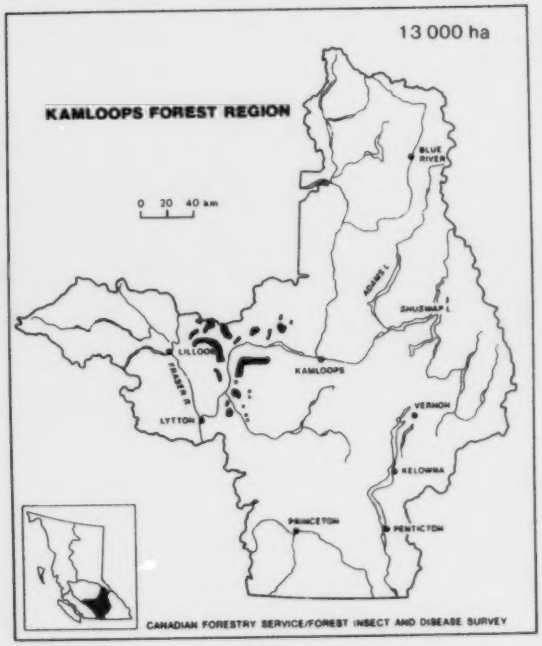
1978

1979

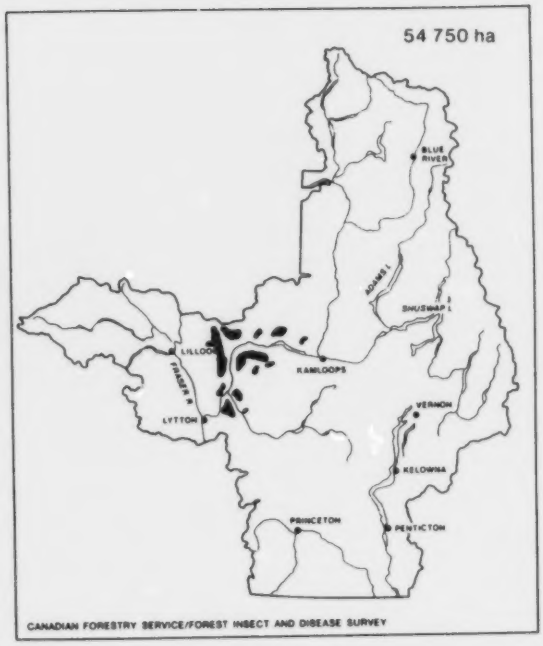
1980

1981

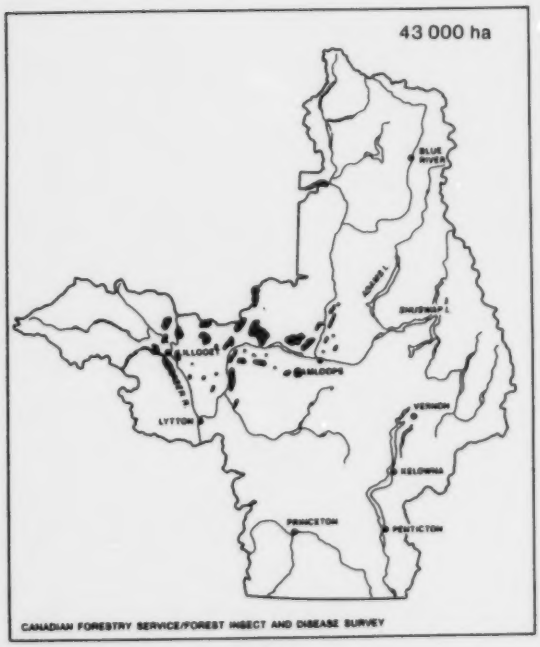
Figure 1 (third page)



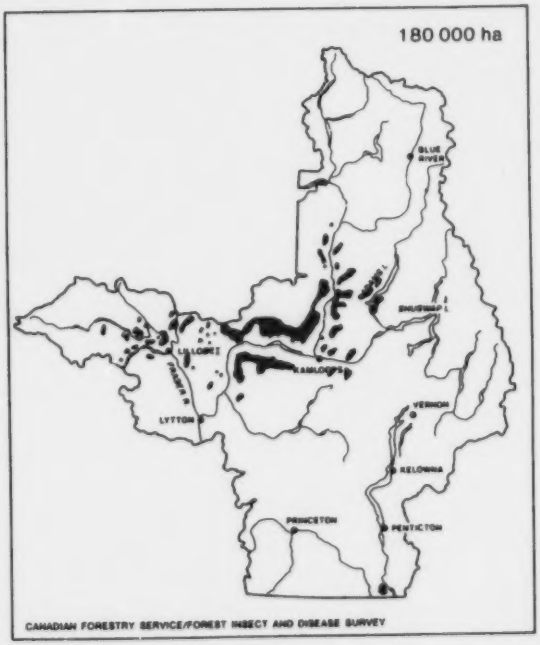
1982



1983



1984



1985

Douglas-fir tussock moth, Orgyia pseudotsugata

No defoliation was noted and no tussock moth larvae were found in beating collections in 1986, compared with 70 ha of severe defoliation in 1985 at Six Mile Lookout and an average of four larvae per beating sample at Twaal and Cherry creeks.

Douglas-fir killed by tussock moth and/or Douglas-fir beetle prior to 1985 remain standing over an estimated 5 000 ha.

Male moths were monitored at 17 locations using six sticky traps per location, baited with (2)-6-heneicosen-11-one at .01% concentration by weight. A total of 73 moths were caught (Table 9), compared to only two at the same locations in 1985.

Table 9. Location and number of male Douglas-fir tussock moths in pheromone-baited sticky traps, Kamloops Forest Region, 1986.

TSA and Location	Avg. no. of moths/trap at .01% pheromone conc.	Total
KAMLOOPS TSA		
Heffley Cr.	<1	2
Stump L.	0	0
Kaneta	0	0
Monte L. Prov. Park	0	0
Chase	0	0
Barnes L.	3	20
Pavilion	0	0
Indian Gardens	0	0
Battle Cr.	0	0
Carquile	0	0
OKANAGAN TSA		
Winfield	5	30
Summerland (McNulty Main)	0	0
Kaleden	2	12
Blue L.	<1	4
Vernon (Bx)	0	0
Armstrong	0	0
MERRITT TSA		
Stemwinder Prov. Park	<1	5
TOTAL		73

Significantly more moths were caught this year at Winfield and Barnes Lake. Populations, however, are expected to be low in 1987 and moth trapping will continue.

Cicadas, Cicadidae

Large numbers of this generally unimportant forest pest killed up to 40% of branch tips on 2- to 5-m high Douglas-fir at Scotch Creek and Adams River near Shuswap Lake. Damage was the result of the egg laying niches cut in branches by cicada adults in 1985. Significant damage has not previously been recorded in B.C.; however, Christmas tree plantations in the U.S.A. have been affected. If cicada populations remain at current levels, similar damage may be expected in 1987.

SPRUCE PESTS

Spruce beetle, Dendroctonus rufipennis

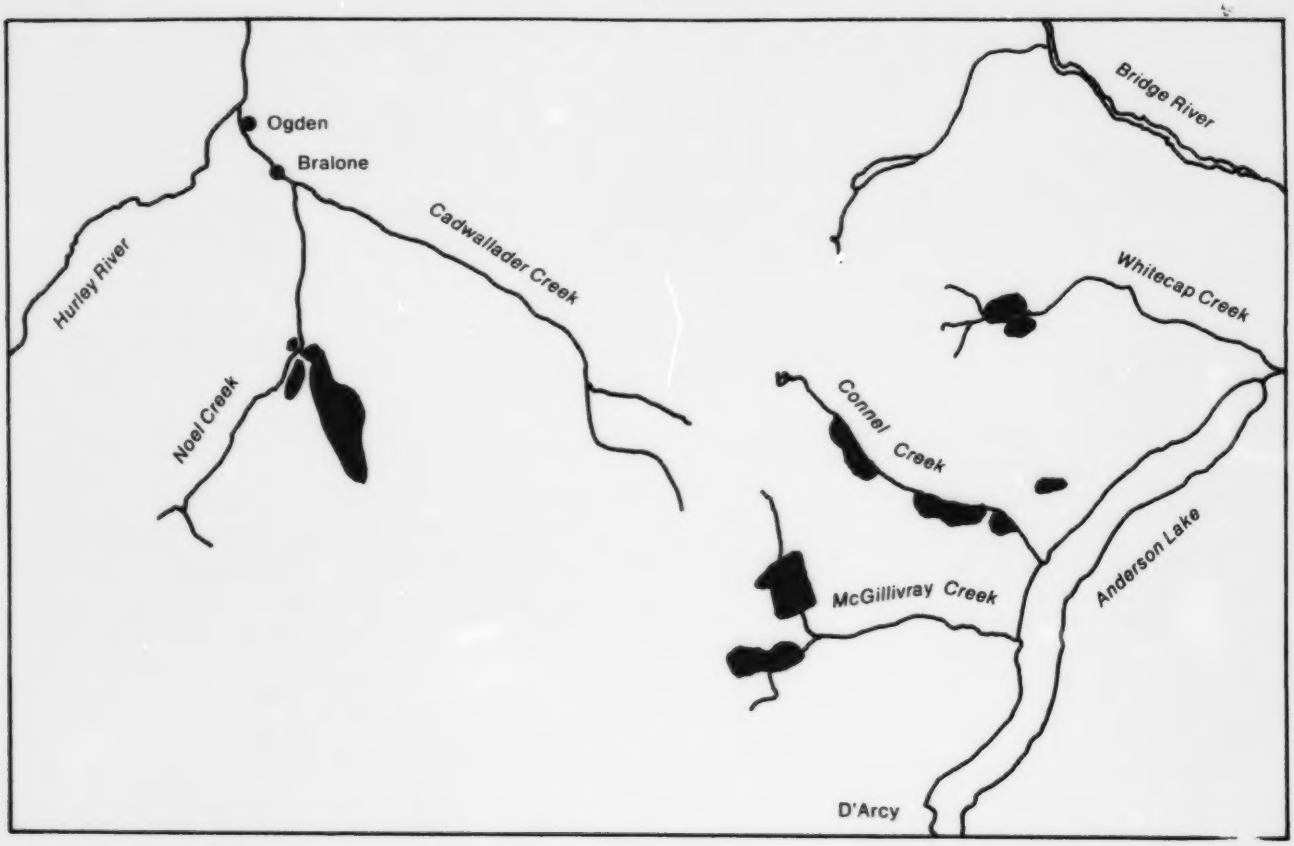
Mature Engelmann spruce were killed in 51 infestations over 2 100 ha in the Lillooet and Merritt TSAs this year, compared with 1 020 ha in five areas in 1985 (Map 5). Approximately 65% of the area infested was located near Anderson and Carpenter lakes in the Lillooet TSA. At Noel Creek south of Gold Bridge, 570 ha were mapped for the first time due to an expanded aerial survey. This infestation has probably been active in standing trees for the past three years. At Whitecap Creek, the infestation expanded to 110 ha but declined to 380 ha from 500 ha at Connel Creek and to 300 ha from 350 ha at McGillivray Creek. Suitable host material at Connel, McGillivray and Whitecap creeks has declined significantly following two to three years of severe tree mortality.

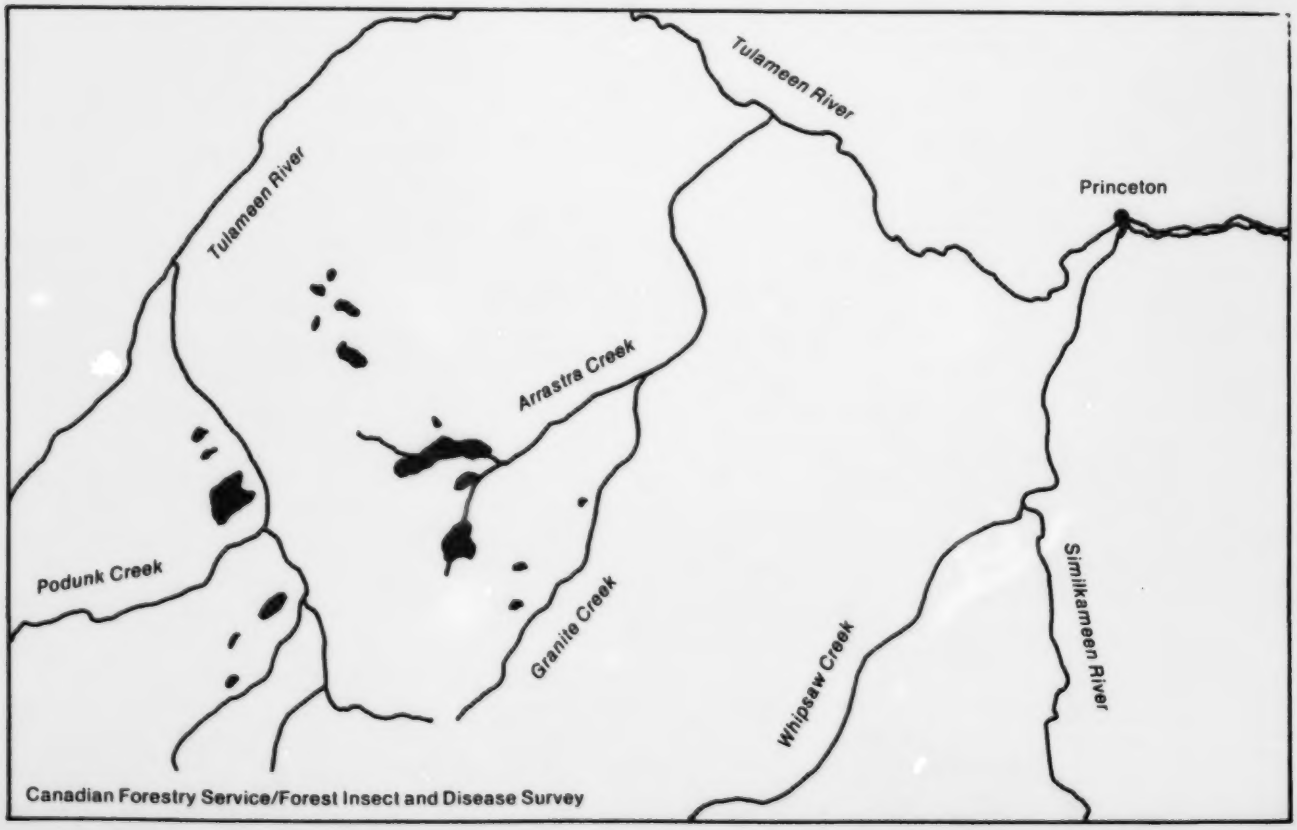
In the Merritt TSA, 710 ha of recently killed Engelmann spruce were mapped for the first time near the headwaters of the Tulameen River west of Princeton. The spruce component of the open, mature spruce and alpine fir stands has been attacked and killed for the past several years. Infestations were scattered through several drainages of the Tulameen with 260 ha of Engelmann spruce mortality in the largest area mapped at Arrastra Creek. North of there, mortality occurred over 150 ha in five infestations at Champion Creek, and over 110 ha in one infestation at Packers Creek. Approximately 190 ha of recently killed spruce were mapped near Podunk Creek and a tributary, Chisholm Creek.

Ground surveys were not undertaken, due to the poor access into the infestations. Historical trends of spruce beetle infestations in Engelmann spruce stands in the area, however, suggest that these infestations should decline due to a lack of susceptible host.

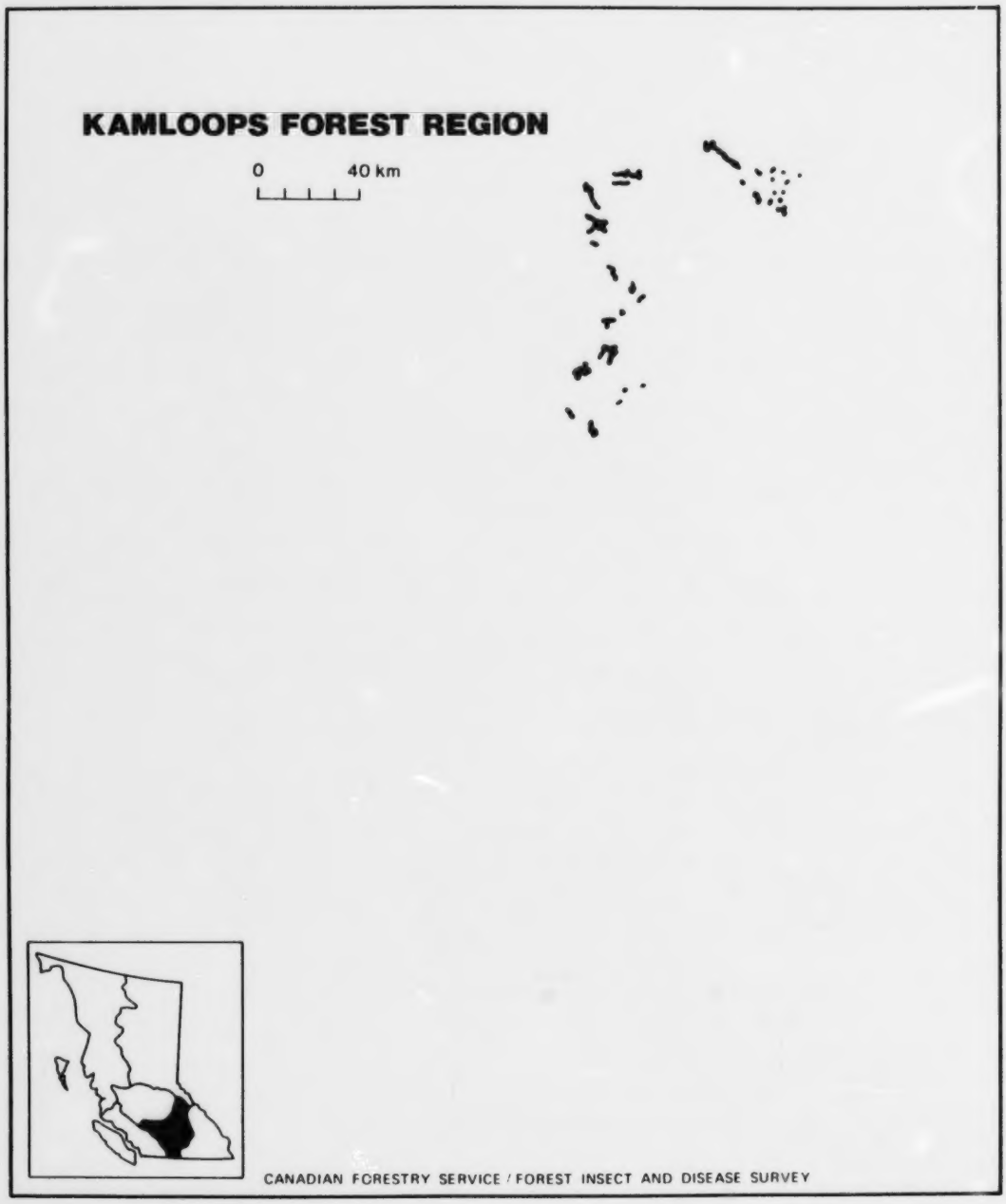
Two-year-cycle spruce budworm, Choristoneura biennis

Increased spruce budworm populations lightly to moderately defoliated multi-age Engelmann spruce and alpine fir over 22 680 ha from the upper North Thompson River Valley to Hobson Lake in Wells Gray Provincial Park and south near Taweel Lake, west of Clearwater (Map 6, Table 10). Infestations were reported in the same general area in 1974, 1976 and 1979-80 over 1 200 ha, 7 980 ha and 6 350 ha, respectively.





Map 5. Areas of mature spruce recently killed by spruce beetle, determined by aerial and ground surveys, Kamloops Forest Region, 1986.



Map 6. Areas of Engelmann spruce and alpine fir defoliated by two-year-cycle spruce budworm, determined by aerial surveys, 1986.

Table 10. Location and area of Engelmann spruce and alpine fir defoliated by two-year-cycle spruce budworm, as determined from aerial surveys, Kamloops Forest Region, 1986.

TSA and Location	Area of Defoliation			
	Light[1]	Moderate	Severe	Total
KAMLOOPS TSA				
N. Thompson R.	3 500	1 000		4 500
Lempriere Cr.	1 900			1 900
Canvas Cr.	730			730
Manteau Cr.	1 020			1 020
Hobson L.	2 790	580		3 370
Archer Cr.	550			550
Daniel Cr.	1 540			1 540
Barella Cr.		1 850		1 850
The Horseshoe	1 120			1 120
Flourmill Cr.	3 660			3 660
Corsica L.	1 810			1 810
Mt. Heger	520			520
Surprise L.	110			110
Total	19 250	3 430		22 680

[1]Light : discolored foliage barely visible from the air, some branch tip and upper crown defoliation.
Moderate: pronounced discoloration, noticeably thin foliage, top third of many trees severely defoliated, some completely stripped.
Severe : bare branch tips and completely defoliated tops, most trees more than 50% total defoliation.

The most severe defoliation, in this the flight year, was 1 000 ha of moderate in the upper North Thompson River Valley; 580 ha of moderate west of Hobson L. and 1 850 ha of moderate at Barella Creek, south of Hobson Lake. Also noteworthy was a total of 2 150 ha of light defoliation along the North Thompson River Valley and tributaries including Lempriere Creek, an historic centre for two-year budworm in the Region since 1974. Defoliation extended into Wells Gray Prov. Park at Hobson Lake (2 790 ha light), south of Hobson Lake at Flourmill Creek (3 660 ha light) and at Corsica Lake (1 810 ha light).

An egg mass sample from the North Thompson River Valley yielded 50 egg masses/10 m^2 of foliage which indicates light defoliation in 1987. The budworm will feed as early instar larvae in 1987 and overwinter in third instar, so defoliation should be more severe in 1988 when larvae mature.

Cooley spruce gall aphid, Adelges cooleyi

Engelmann and white spruce at the BCFS Skimikin Seed Orchard were again infested by spruce gall aphid, although not as severely as in 1985. Between 5 and 10% of the new shoots were galled on trees from West Kootenay provenances and 10 to 20% of the shoots were infested on trees from the Bulkley Valley and the Central Plateau areas. Control action by BCFS personnel in 1985/86 reduced the rate of infestation.

Spruce gall aphid is a common pest of spruce throughout the Kamloops Region. Serious damage can occur when immature trees or seedlings are attacked in seed orchards and nurseries.

ALPINE FIR PESTS

Western balsam bark beetle, Dryocoetes confusus

Approximately 2 290 ha of mature alpine fir were killed by this beetle in the Region this year, up from only 600 ha in 1985 (Table 11). Greater aerial coverage was partly responsible for the increase. The largest area of mortality covered nearly 1 000 ha in the Lillooet TSA southeast of Lytton to the Nicomen River including Kanaka Mountain. Other small, isolated infestations were located near Chase Creek in the Okanagan TSA over 910 ha and near Harold Creek in the Merritt TSA over 30 ha.

In the Kamloops TSA, recent tree mortality was mapped over 160 ha. Aerial surveys did not cover the Cariboo Plateau area where tree mortality has been prevalent for decades.

Table 11. Location, area, number and volume of alpine fir recently killed by western balsam bark beetle complex, determined from aerial surveys, Kamloops Forest Region, 1986.

TSA and Location	Area (ha)	No. of trees killed	Total volume of trees killed (m^3)
KAMLOOPS TSA			
Wentworth Cr.	160	600	300
Subtotal	160	600	300
LILLOOET TSA			
Kanaka Mtn.	810	500	250
Nicomen R.	90	300	150
Lytton Cr.	50	100	50
Kwoiek Cr.	240	700	350
Subtotal	1 190	1 600	800

...

TSA and Location	Area (ha)	No. of trees killed	Total volume of trees killed (m^3)
OKANAGAN TSA			
Beak Cr.	30	20	10
Frank Ward Cr.	260	500	250
Kernaghan L.	140	100	50
Chase Cr.	430	1 600	800
Mail Cr.	50	100	50
Subtotal	910	2 320	1 160
MERRITT TSA			
Harold L.	30	50	25
Subtotal	30	50	25
SUMMARY			
KAMLOOPS TSA	160	600	300
LILLOOET TSA	1 190	1 600	800
OKANAGAN TSA	910	2 320	1 160
MERRITT TSA	30	50	25
GRAND TOTAL	2 290	4 570	2 285

Western balsam bark beetle and its associated fungus Ceratocystis sp. are a chronic problem of inaccessible high elevation alpine fir stands throughout the Region. Mortality does not fluctuate dramatically as with other bark beetles; however, some years it is mapped more extensively from the air.

LARCH PESTS

Larch budmoth, Zeiraphera improbana

Larch budmoth infestations east of the Okanagan Valley collapsed in 1986. Last year, 8 900 ha of western larch were lightly to severely defoliated in the second year of recent defoliation. In late May 1986, larvae were abundant east of Penticton; however, larval mortality from unknown causes eliminated the population before any noticeable feeding occurred.

An average of 24 (range 2-152) male moths were caught in 14 sticky traps baited with a pheromone made up of 0.5% concentration 50% trans-11-tetradecenyl, 50% trans-9-dodecenyl placed at four locations (Table 12). The historical pattern of larch budmoth infestations in the Kamloops Region has been two years of defoliation followed by a population collapse. Populations should remain low next year.

Table 12. Location and number of larch budmoth male adults in pheromone-baited traps, Kamloops Forest Region, 1986.

Location	No. of traps	No. of male adults	
		Average	Total
Inkaneep	5	12	59
Silverstar Mtn.	2	97	194
Gillard Main	2	24	48
Ellis Lake	5	7	34
Total			335

Trapping and sampling to determine the biology of larch budmoth will continue in 1987 if populations reappear.

Larch casebearer, Coleophora laricella

Larch casebearer populations remained low throughout the range of western larch in the Okanagan TSA, where defoliation was last mapped over 1 100 ha near Vernon in 1984.

No male moths were caught in groups of five sticky traps baited with the pheromone cis-5-decenol at 0.5% concentration placed near Salmon Arm and Vernon. Traps at the same locations in 1985 caught an average of 235 adults (range 96-1176).

Counts of overwintering casebearer larvae done in November at Shuttleworth Creek east of Okanagan Falls averaged 5.5 per 100 spur shoots. These counts were similar to 1985 indicating low populations and negligible defoliation in 1987. Criterion for forecasting casebearer populations was developed by Bousfield et al in the USA.

Larch needle blight, Hypodermella laricis

Declines in infection levels continued for the third consecutive year, and only light discoloration was detected in three small stands, compared to 110 ha of severe infection in 1985.

Near Salmon Arm, Falkland and Okanagan Falls, 5 to 10% of the foliage was discolored on widely scattered individual trees, in the same areas which were severely infected in 1984. Severe infection could occur in 1987 if spring weather is warm and damp at the time of spore release.

Larch needle cast, Meria laricis

Light to moderate infection of needles in multi-age western larch stands was evident at three locations in the north Okanagan Valley, up slightly from 1985. Between Vernon and Cherryville, larch was 5 to 40% discolored in several scattered patches of 2- to 200-ha. West of Sicamous near

the limits of the host range, scattered individual trees were 20 to 40% discolored.

If suitable conditions occur for spore release in 1987, infections could increase.

WESTERN HEMLOCK PESTS

Western blackheaded budworm, Acleris gloverana

Populations collapsed in Interior wet belt stands in the Region this year, down dramatically from 1985 when 3 100 ha were lightly defoliated mainly in Wells Gray Provincial Park.

A total of only ten larvae were collected in three standard FIDS samples in western hemlock stands, down from an average of 43 larvae (range 3-300) last year.

The cause of the decline is not known; however, diseases and weather usually influence the rise and fall of budworm populations.

Hemlock sawfly, Neodiprion sp.

Sawfly populations in wet belt cedar-hemlock stands were down slightly to an average of 27 larvae per positive beating collection, from an average of 70 larvae per collection in 1985. There was no noticeable defoliation recorded.

Based on historical trends, populations should remain static next year. Hemlock sawfly is usually only a serious defoliator when associated with other major insect pests including western blackheaded budworm and western hemlock looper.

DECIDUOUS PESTS

Gypsy moth, Lymantria dispar

For the eleventh consecutive year pheromone-baited sticky traps, to monitor the spread of gypsy moth into British Columbia, were set out by FIDS. One male moth was caught in a trap at Boyce, Gyro Beach Park in Kelowna.

Traps were placed in 40 locations including provincial parks and roadside rest areas, with emphasis on locations frequented by EXPO 86 visitors and other tourists.

The survey, part of a cooperative project with Plant Quarantine, Agriculture Canada and British Columbia Forest Service, found moths elsewhere in the Region including seven in four traps in Kelowna, and one at Knutsford, south of Kamloops. Surveys will continue to monitor the possible development of populations.

PESTS OF YOUNG STANDS

Young stands surveyed at 13 locations in three TSAs using fixed-radius plots on transects were affected by several important pests (Table 13).

Pests found to be common on pine were needle, stem and root diseases, pine needle sheathminer and pine terminal weevil. Western spruce budworm and two-year-cycle budworm infested Douglas-fir and Engelmann spruce, respectively. An unidentified gall affected branches and stems on alpine fir up to 2.5 m high.

Table 13. Pests of young stands in the Kamloops Region, 1986.

TSA/Pest	Host[1]	Location	Damage	Tree ht (m)
OKANAGAN TSA				
Armillaria root rot, Armillaria sp.	lP	Trout Cr. Rd. Km 28	2% of trees infected	2
Stalactiform blister rust, Cronartium coleosporioides	lP	"	1% of trees infected	2
Lophodermella needle cast, Lophodermella sp. and moisture stress	lP	McKinney Cr. Rd. Km 20	80% of plantation trees 20-90% discolored	1
Pine terminal weevil, Pissodes terminalis	lP	Okanagan Falls Rd. Km 32	2% of trees infested	1-5
Pine needle sheathminer, Zelleria sp.	lP	Scotch Creek Fly Hills	50-100% current growth discolored	3-4
Western spruce budworm, Choristoneura occidentalis	Df	Canoe Rd., Km 6 Falkland; Blue Lake	40-80% current growth defoliated	1-5
Unknown branch and stem galls	alF	Apex-Alpine Rd. Km 9	30% of trees on 1 ha affected	0.5-2.5
KAMLOOPS TSA				
Armillaria root rot, Armillaria sp.	lP	Blue River	2-10 dead pine in 0.25-0.5-ha pockets	1-5
Two-year budworm, C. biennis	eS	Knouff Lake	70% of seedlings 20% defoliated	0.3
	eS, alF	Badger Lake	80-100% of current growth defoliated	2

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TSA/Pest	Host[1]	Location	Damage	Tree ht (m)
LILLOOET TSA				
Pine terminal weevil, P. terminalis	lP	McKay Creek	30% of trees with dead tops	2.5

[1]lP - lodgepole pine; Df - Douglas-fir; alF - alpine fir; eS - Engelmann spruce

MINOR PESTS

Observations, collections and records were made of non-economic and important pests at endemic levels (Table 14). These pests included: black army cutworm near Clearwater, fall webworm on roadside shrubs throughout much of the Region, Warren's root collar weevil near Adams Lake, and other insects and diseases of deciduous trees.

Table 14. Currently active pests of minor significance in the Kamloops Forest Region, 1986.

TSA and Pest	Host[1]	Location	Damage	Status
KAMLOOPS TSA				
leaf beetles, Pyrrhalta sp.	Al	Battle Cr.	Trees 100% skeletonized over 1 ha.	Increasing
Warren's root collar weevil, Hylobius warreni	lP	Graffunder L.	Eight dead pine/ha in 50-ha plantation.	Increasing
Western winter moth, Erannis vancouverensis	M	Eakin Cr.	Trees 100% defoliated over 20 ha.	Increasing
A Douglas-fir needle disease, Tiarosporella pseudotsugae	Df	Carabine Cr.	About 40% of trees 30% discolored over 5 ha.	Static
Black army cutworm, Actebia fennica	traps	Clearwater	Eleven moths caught in pheromone traps at Messiter; 12 at Otter Cr., 9 at Collen Cr. Average 3.5 moths/trap.	Static

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TSA and Pest	Host[1]	Location	Damage	Status
Douglas-fir cone moth, *Dioryctria pseudotsugella*	Df	Cache Cr. - Kamloops	From 5 to 15 larvae common in beatings with *Choristoneura occidentalis*	Increasing
MERRITT TSA				
Satin moth, *Leucoma salicis*	bCo	Nicola	Several .5 ha areas 60-90% defoliated near lake	Increasing
OKANAGAN TSA				
Western tent caterpillar, *Malacosoma pluviale*	Al	Km 11 Railroad (Chute L.)	Ten percent defoliation over 1 ha.	Static
Fall webworm, *Hyphantria cunea*	Misc. decid.	Ellison L.	Roadside shrubs, 50-80% defoliated	Increasing
		Hwy. 97, Kamloops-Vernon		Static
Western pine shoot borer, *Eucosma sonomana*	pP	Garnet L.	Two percent of branch tips infested on single trees.	Static
Poplar leaf and shoot blight, *Venturia macularis*	tA	Km 3 Brewer Cr. Rd.	Small clones 5% discolored.	Static
Lodgepole pine dwarf mistletoe, *Arceuthobium americanum*	lP	Ellis L., Km 20, Fish L. Rd.	All stems 20-80% infected.	Static

[1] Al = alder; lP = lodgepole pine; M = maple; Df = Douglas-fir; bCo = black cottonwood; pP = ponderosa pine, tA = trembling aspen.

FOREST PESTS IN PROVINCIAL PARKS

The annual pest survey of provincial parks in Kamloops Region was continued for the sixth consecutive year. Pests were recorded in 21 of the 39 parks examined. Some of the more damaging pests were mountain pine beetle, Dendroctonus ponderosae, western pine beetle, D. brevicomis, western spruce budworm, Choristoneura occidentalis, and two-year-cycle spruce budworm, C. biennis.

Mountain pine beetle continues to be the single most damaging pest in the parks, resulting in mortality of lodgepole pine over 410 ha in Okanagan Mountain Park, similar to 1985 and 176 ha in Cathedral Park, down from 200 ha last year. Western pine beetle killed over 100 mature ponderosa pine in Ellison Park.

Western spruce budworm lightly defoliated Douglas-fir throughout Monte Lake, Roderick Haig-Brown, and Seton Portage parks. At Paul Lake the budworm moderately defoliated mature Douglas-fir over 380 ha, up from 250 ha moderately defoliated in 1985. Two-year-cycle spruce budworm lightly defoliated 9 180 ha and moderately defoliated 2 590 ha of Engelmann spruce and alpine fir along Hobson and Clearwater lakes in Wells Gray Provincial Park.

Single pheromone-baited sticky traps were set out in 23 parks throughout the Region to monitor the spread of gypsy moth, Lymantria dispar, but none was caught.